

**Testimony of Thomas Haueter, Deputy Director
Office of Aviation Safety
National Transportation Safety Board
before the
U.S. House of Representatives
Committee on Transportation and Infrastructure
Subcommittee on Aviation
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Good afternoon Chairman Mica, Ranking Member Costello, and Members of the Subcommittee. My name is Tom Haueter. I am the Deputy Director of the National Transportation Safety Board's Office of Aviation Safety. The Safety Board's Chairman, Mark Rosenker, asked me to represent the Board today to discuss issues in Aviation Safety.

Since becoming an independent agency, the Safety Board has issued over 3,500 aviation safety recommendations. Eighty-two percent of these recommendations have been adopted by the Federal Aviation Administration (FAA) or the aviation industry. We believe that in part through the Safety Board's accident investigations and recommendations, the United States enjoys the safest commercial air transportation system in the world. However, as the recent accident in Lexington, Kentucky shows, we must maintain our vigilance and need to continuously seek ways to make this very safe system even safer.

I would like to highlight a few areas where we believe additional efforts are required to reduce the potential for serious aviation accidents and some of the successes that we have seen in recent investigations.

Runway Incursions

In March 1977, in what remains the world's deadliest aviation accident, two passenger jumbo jets collided on a runway at Tenerife, Canary Islands. That accident resulted in the deaths of 583 passengers and crew. The deadliest U.S. runway incursion accident was a collision between a USAir 737 and a Skywest Metroliner commuter airplane at Los Angeles International Airport (LAX) in February 1991, killing 34.

Most recently, in July 2006, at O'Hare International Airport, a United 737 passenger jet and an Atlas Air 747 cargo airplane nearly collided. The 747 had been cleared to land and was taxiing on the runway towards the cargo area when the 737 was cleared to take off on the intersecting runway, over the 747. The pilot of the United 737 passenger jet took evasive action by taking off early. A collision was avoided by less than 200 feet.

The FAA has taken action to inform pilots and controllers of potential runway incursions, improve airport markings, and install the Airport Movement Area Safety System (AMASS) and Airport Surface Detection Equipment Model X (ASDE-X). These systems are an improvement, but are not sufficient as designed to prevent all runway incursions. The runway incursion rate in

the United States has not appreciably changed over the past 4 years, and stands at about 5.2 runway incursions per 1,000,000 tower operations, despite these improvements.

Runway incursion prevention has been on the Safety Board's "Most Wanted List" since the list's inception in 1990. A total of 21 runway incursion recommendations have been on the list over the years; currently, only one recommendation remains open. That recommendation urges the FAA to "require, at all airports with scheduled passenger service, a ground movement safety system that will prevent runway incursions; the system should provide a direct warning capability to flight crews. In addition, demonstrate through computer simulations or other means that the system will, in fact, prevent incursions." This recommendation is currently classified "Open—Unacceptable Response."

As indicated in this recommendation, information needs to be provided directly to the flight crews as expeditiously as possible to prevent incursions. The issue is one of reaction time. Safety Board investigations have found that AMASS is not adequate to prevent serious runway collisions, because too much time is lost routing valuable information through air traffic control. After an AMASS alert, the controller must determine the nature of the problem, determine the location, identify the aircraft involved, and determine what action to take. Only after all of these determinations are made can appropriate warnings or instructions be issued. The flight crew must then respond to the situation and take action. Simulations of AMASS performance using data from actual incursions show that alerts may occur as little as 8 to 11 seconds before a potential collision. In recent incidents, AMASS did not alert controllers in time to be effective, and the situations were instead resolved by flight crew actions that sometimes bordered on heroics or just plain luck.

The FAA is developing several technologies to further reduce the potential for runway incursions, such as runway occupancy signals that will flash the approach path lights when another aircraft or vehicle is on the runway, enhance the visibility of hold lines, and runway status lights to warn pilots that it is unsafe to enter a runway.

Aircraft Fuel Tank Flammability

Since 1989, aircraft fuel tank explosions have resulted in 346 fatalities. On July 17, 1996, Trans World Airlines, Inc. (TWA) flight 800, a Boeing 747-131, crashed in the Atlantic Ocean near East Moriches, New York. All 230 people on board were killed. The Safety Board found that the cause of the accident was an explosion of the center wing fuel tank, resulting from ignition of the flammable fuel/air mixture inside the tank. The source of ignition energy for the explosion could not be determined with certainty; however, the source of the ignition was most likely a short circuit of electrical wiring associated with the fuel quantity indication system.

Most recently, in May 2006, a fuel vapor explosion occurred in the left wing of a Transmile Airlines 727 in Bangalore, India, resulting in substantial damage to the wing structure. The explosion occurred while the airplane was being towed, and fortunately, there were no injuries. The investigation found that the ignition source was the chafing of fuel pump wires inside a conduit that traversed the interior of the fuel tank, even though the fuel pump wires had been inspected and inserted into a protective sleeve to prevent chafing.

The investigation of the TWA flight 800 accident and subsequent fuel tank explosions found that a fuel tank design and certification philosophy that relies solely on the elimination of every ignition source, while accepting the existence of fuel tank flammability, is fundamentally flawed because experience has demonstrated that it is impossible to eliminate all ignition sources. Further, the risk of explosion exists for all fuel tanks, not just center, or fuselage, fuel tanks. The Safety Board believes that operating transport-category airplanes with flammable fuel/air vapors in fuel tanks presents an avoidable risk of explosion.

One recommendation regarding fuel tank flammability is currently on the Board's Most Wanted List and is classified "Open—Acceptable Response." That recommendation asks the FAA to give significant consideration "to the development of airplane design modification, such as nitrogen-inerting systems and the addition of insulation between heat-generating equipment and fuel tanks. Appropriate modifications should apply to newly certificated airplanes and, where feasible, to existing airplanes."

In 2002, the FAA developed a prototype inerting system that could be retrofitted into existing airplanes. The system has been flight tested by the FAA, Boeing, and Airbus, and the results indicate that fuel tank inerting is practical and effective.

The comment period on the FAA's notice of proposed rulemaking (NPRM) for the flammability reduction installation is now closed and the Board is awaiting a final rule from the FAA. The Safety Board hopes that the lessons learned from TWA 800 and other fuel tank explosions will result in the installation of systems to preclude the operation of transport-category airplanes with flammable fuel/air vapors in all fuel tanks on both passenger and cargo aircraft.

Aircraft Icing

Aircraft icing safety issues cover two different types of icing events: in-flight icing and icing that occurs on the ground, more commonly called upper-wing icing. In-flight icing occurred in the 1994 accident of an American Eagle ATR-72 commuter airplane in Indiana, which took 68 lives. Another accident occurred in Michigan in 1997 involving a Comair Embraer 120RT, which took 29 lives.

Aircraft icing issues have been on the Safety Board's "Most Wanted List" since 1997. Currently, four recommendations are on the list and all four are classified "Open—Unacceptable Response." These recommendations to the FAA address the need to expand the icing certification envelope to include freezing drizzle/freezing rain and mixed water/ice crystal conditions; as necessary; revise regulations to ensure that airplanes are properly tested for all conditions in which they are authorized to operate, or are otherwise shown to be capable of safe flight into such conditions; conduct additional research with NASA to identify realistic acceptable ice accumulations; and ensure turbopropeller-driven airplanes fulfill the requirements of the revised icing certification standards. The Safety Board has issued additional recommendations regarding icing that are not on the Most Wanted List.

More recently, on January 2, 2006, an American Eagle Saab-Scania SF340 encountered icing conditions during the en route climb after departure from San Luis Obispo, California. The airplane departed controlled flight at an altitude of about 11,500 feet mean sea level (msl), and the flight crew recovered control of the airplane at about 6,500 feet. There were no injuries to the 29 persons on board and the airplane did not sustain any damage. The digital flight data recorder (DFDR) showed that the upset began at 130 knots indicated airspeed and before the stall warning activated. The airplane rolled to 86° left wing down and then 140° right wing down. The loss of control lasted about 50 seconds, and the airplane lost 4,000 feet.

Following the accident near San Luis Obispo, the Safety Board recommended that the FAA require Saab SF340 series airplanes to maintain a minimum operating speed during icing encounters, to exit icing conditions if this speed cannot be maintained, to modify the stall protection logic in the SF340 series for flight into known icing conditions, to require the installation of an icing detection system on Saab 340 series, and to require all operators of turbopropeller-driven airplanes to disengage the autopilot and fly the airplane manually when operating in icing conditions.

Unfortunately, these high-risk upsets, such as that which occurred in the Saab SF340, continue to occur and mitigating actions are imposed on a case-by-case basis rather than a comprehensive upgrade of certification requirements and retrofit of the existing fleet as recommended in 1997.

From 1987 to 2003, 26 icing-related accidents and incidents occurred involving Cessna 208 series airplanes that involved both in-flight and ground accumulations of ice, fatally injuring 36 people. Fifteen of the 26 icing-related events resulted from ice that had accumulated while the airplane was in flight.

The investigation of an October 6, 2005, accident in Canada found that the pilot conducted a preflight inspection that included a tactile examination of the wings for ice and frost contamination. The entire accident flight, from takeoff to a near immediate attempt to return to the airport, lasted only about 5 minutes. The airplane was not equipped with flight recorders. Based on the circumstances of the accident, the Safety Board became concerned that the airplane, which was certified for flight into known icing, did not maintain flight in moderate icing conditions long enough to successfully land the airplane.

On November 19, 2005, a Cessna 208B was destroyed when it impacted terrain while on approach to Moscow, Russia. The two Russian certificated pilots and six passengers were killed. The accident is the first time that the Safety Board has investigated an accident in which a Cessna 208B was equipped with a cockpit voice recorder (CVR) and flight data recorder (FDR). The recorders were installed to comply with Russian certification requirements. The data from these recorders provided a significant amount of information that greatly aided investigators in determining the sequence of events in the accident and quantifying the effects of icing on the airplane's performance. The data showed that the airplane departed controlled flight at a speed only 3 knots lower than the published minimum operating icing airspeed and that no stall warning was provided to the pilots.

The Safety Board issued three urgent recommendations to the FAA asking that all operators of Cessna 208 series airplanes be required to maintain a minimum operating airspeed of 120 knots during flight in icing conditions, that the operation of Cessna 208 airplanes be prohibited in more than light icing conditions, and that the autopilot be disengaged and the airplane flown manually when operating in icing conditions. These far reaching recommendations would not have been possible without the recorded voice and flight data provided by the Russian accident.

In addition to in-flight icing, the Safety Board found that 10 of the 26 Cessna 208 accidents and incidents involved inadequate ice removal that had accumulated while the airplane was on the ground before takeoff. The Safety Board recommended that all pilots and operators of Cessna 208 series airplanes needed to conduct a visual and tactile examination of the wing and horizontal stabilizer leading edges and upper surfaces to ensure that those surfaces are free of ice and/or frost contamination before any flight from a location at which the temperatures are conducive to frost or ground icing.

Another example of ground icing is the November 28, 2004, accident involving an Air Castle Corporation Canadair CL-600, which crashed shortly after takeoff at Montrose, Colorado, resulting in three persons being killed and three with serious injuries. The flight crew failed to ensure that the airplane's wings were free of ice or snow contamination that accumulated while the airplane was on the ground. Of particular concern to the Safety Board is that a 14 *Code of Federal Regulations* (CFR) Part 135-qualified captain and first officer, both of whom received winter weather operations training in accordance with the company's FAA-approved winter operations procedures, could fail to understand the insidious nature of upper wing surface contamination and its threat to the safety of the flight. As a result of the investigation, the Safety Board recommended that the FAA "develop visual and tactile training aids to accurately depict small amounts of upper wing surface contamination and require all commercial airplane operators to incorporate these training aids into their initial and recurrent training."

Fatigue

The safety issue of operator fatigue has been on the Safety Board's Most Wanted List since the list's inception. Currently, the aviation area of the Most Wanted List includes three recommendations concerning pilot fatigue and one recommendation concerning maintenance crew fatigue. In December 1995, the FAA issued an NPRM to update flight and duty regulations for airline pilots; however, in the intervening 10 years, the regulations have not been revised. Three of the recommendations on the Most Wanted List are classified "Open—Unacceptable Response" due to a lack of progress.

In response to the Safety Board's recommendation to modify and simplify flight crew hours-of-service regulations to take into consideration factors shown by research, scientific evidence, and industry experience to affect crew alertness, the FAA indicated that an aviation rulemaking advisory committee (ARAC) had produced some promising work that would simplify hours-of-service practices for Part 135 operations. However, the Safety Board has not seen this work, nor has the FAA decided whether to make explicit regulatory changes based on the ARAC's work. The Board is aware that the FAA has attempted on three occasions to reach

consensus with the industry on a proposed rule but has been unsuccessful. The Board also notes that the ARAC only focused on Part 135 pilots, not all airline pilots, including those that fly commercial passenger airplanes.

At this time, the Safety Board is not aware of any current FAA activity to address fatigue issues in aviation safety, yet we continue to be concerned about the potential for accidents as a result of errors made by fatigued pilots or maintenance crews.

Landing Distance Calculation

On December 8, 2005, Southwest Airlines flight 1248, a Boeing 737, departed the end of a snow-contaminated runway (runway 31C) at Chicago Midway Airport (MDW), Chicago, Illinois, after landing. The airplane then rolled through a blast fence and a perimeter fence and then into traffic on an off-airport street. The airplane came to a stop after colliding with two cars, which resulted in the death of a child passenger in one of the vehicles. The investigation found that the flight crew used an on-board laptop performance computer (OPC) provided in the cockpit of Southwest Airlines' airplanes by the company to calculate the landing distance for the existing tailwind and contaminated runway. The OPC calculations provided little safety margin for stopping distance. The FDR data revealed that about 18 seconds passed from the time the airplane touched down to the time the thrust reversers were deployed.

Further, the investigation found that in permitting thrust reverser consideration, the FAA provisions left very little safety margin should thrust reversers fail or are inadvertently not utilized when landing on contaminated runways. The FAA allows operators to take credit for thrust reversers when landing on short contaminated runways. For example, the required runway length for 737-700 model airplanes is about 1,000 feet less with thrust reversers than the required runway length without the reverse thrust credit. In the Midway accident, the accident airplane could not be stopped on the runway because of the delay in thrust reverser deployment combined with the absence of an extra safety margin.

On January 27, 2006, the Safety Board issued an urgent recommendation for the FAA to "immediately prohibit all 14 CFR Part 121 operators from using the reverse thrust credit in landing performance calculations." On June 7, 2006, the FAA announced that it would issue operational requirements for air carriers requiring that, by October 1, 2006, jet operators include a 15 percent safety factor in landing distance calculation. The Safety Board indicated its support for this approach. In late August, the FAA indicated that, based on the large number of negative comments that it received in response to the announcement, it would start a more formal rulemaking process that will take considerably longer to implement. However, to spur faster action, on August 31, 2006, the FAA issued a Safety Alert For Operators (SAFO) recommending the landing distance calculation procedures in the June 7 announcement, including the 15 percent safety factor. The Safety Board is concerned that, because SAFOs are advisory only and operators are not required to comply with these alerts, operators will not take this important safety action; the Board is also concerned that the FAA's rulemaking will require considerable additional time to implement the intent of our recommendation.

Emergency Medical Services (EMS)

Between January 2002 and January 2005, 55 EMS aircraft (both airplanes and helicopters) accidents occurred in the United States (this number of EMS accidents had not been seen since the 1980s). These accidents resulted in 54 fatalities and 18 serious injuries. As a result, the Safety Board initiated a special investigation of these 55 accidents and identified the following recurring safety issues: less stringent requirements for EMS operations conducted without patients onboard; a lack of aviation flight risk evaluation programs for EMS operations; a lack of consistent, comprehensive flight dispatch procedures for EMS operations; and no requirements to use technologies such as terrain awareness and warning systems (TAWS) to enhance EMS flight safety.

The Safety Board examined similar safety issues after the occurrence of 59 EMS accidents between May 1978 and December 1986, and concluded in a 1988 safety study that many areas of EMS operations needed improvement; those included weather forecasting, operations during instrument meteorological conditions, personnel training requirements, design standards, crashworthiness, and EMS operations management. As a result of its findings, the Board issued 19 safety recommendations to the FAA and others, which have since been closed. Most of the recommendations to the FAA were closed as a result of the June 20, 1991, issuance of Advisory Circular (AC) 135-14A "Emergency Medical Services/Helicopter (EMS/H)." Although the Safety Board expressed concern at the time that the FAA chose to issue an AC instead of mandatory regulations, the number of EMS accidents was decreasing, thus the recommendations were closed. Despite the guidance provided in AC 135-14A and AC 135-15, EMS aircraft accidents have continued to occur in significant numbers.

Although the FAA took positive steps to improve EMS operation safety, the Safety Board was concerned that the FAA had not imposed any requirements for all aircraft EMS operators regarding the safety issues identified during the Board's special investigation. The Board is concerned that, without more rigorous standards, some EMS operators will continue to operate in an unsafe manner, which could lead to further accidents. Consequently, on February 7, 2006, the Safety Board recommended that the FAA: require all emergency medical services operators to comply with 14 CFR Part 135 operations specifications during the conduct of all flights with medical personnel onboard; develop and implement flight risk evaluation programs; use formalized dispatch and flight-following procedures that include up-to-date weather information and assistance with in flight risk assessment decisions; to install terrain awareness and warning systems on their aircraft; and to provide adequate training to ensure that flight crews are capable of using the systems to safely conduct EMS operations.

The FAA responded on May 30, 2006, that it was still evaluating these recommendations.

Since January 1, 2006, 14 additional EMS accidents have occurred with a total of 5 fatalities.

Turbine Engine Disk Failure

On June 2, 2006, an American Airlines Boeing 767-223(ER) equipped with General Electric (GE) CF6-80A engines experienced an uncontained failure of the high pressure turbine (HPT) stage 1 disk in the No. 1 (left) engine during a high-power ground run for maintenance at Los Angeles International Airport, Los Angeles, California. There were no injuries, but the airplane sustained substantial damage.

The HPT stage 1 disk had ruptured and was completely missing from the engine. The pieces of the ruptured disk revealed that it had broken into four pieces. One piece of the disk, which initially bounced off of the ground before penetrating the airplane, completely severed the airplane's left-hand keel beam and partially severed the right-hand keel beam before exiting the airplane and becoming lodged in the No. 2 engine's exhaust duct. A second piece of the disk was found in the airplane embedded in an air duct. A third piece of the disk was found about 2,500 feet away from the airplane against an airport perimeter fence after crossing two active runways and taxiways. The fourth triangular-shaped piece of the disk was found embedded in the engine pylon. There were numerous holes in the left and right wing fuel tanks where fuel leaked out, feeding the ground fire that burned the left wing and the fuselage aft of the wing.

Metallurgical examination of the pieces of the disk at the Safety Board's materials laboratory revealed that the disk ruptured from a rim-to-bore radial fracture that had originated at a small dent at a blade slot, bottom aft corner. The examination also revealed that the aft corner in two other slot bottoms each contained a crack that coincided with a small dent. It was not possible to determine how fast the fatigue fracture propagated before the disk ruptured. The American Airlines incident raises serious safety concerns because, if the disk had ruptured during flight rather than on the ground during maintenance, the airplane quite possibly would not have been able to maintain safe flight.

Similarly, on September 22, 2000, a US Airways Boeing 767-2B7(ER) airplane, equipped with GE CF6-80C2B2 engines, experienced an uncontained failure of the HPT stage 1 disk in the No. 1 engine during a high-power ground run for maintenance at Philadelphia International Airport, Philadelphia, Pennsylvania. The uncontained failure caused a fire under the left wing of the airplane. The mechanics were not injured, and the No. 1 engine and the airplane sustained substantial damage. At the time of the failure, the disk had accumulated 7,547 cycles (or flights) since new (CSN). The Board is also aware of an uncontained HPT stage 1 disk rupture that occurred on an Air New Zealand Boeing 767-219(ER) equipped with GE CF6-80A engines while the airplane was climbing through 11,000 feet on a flight from Brisbane, Australia, to Auckland, New Zealand, on December 8, 2002. A section of the disk's rim and web separated and, after penetrating the engine's case and nacelle, damaged the left wing's leading edge. The airplane was able to return to Brisbane for a safe landing, and none of the 10 crewmembers and 190 passengers onboard were injured. At the time of the incident, the ruptured Air Zealand HPT stage 1 disk had accumulated 12,485 CSN.

Although some of the issues identified thus far in the Board's investigation of the American Airlines event were previously addressed by recommendations resulting from the US Airways investigation, the FAA's corrective actions appear inadequate. Based on the fact that an

uncontained failure of an HPT stage 1 disk has now recurred, we believe more stringent inspection requirements would be justified.

The Safety Board is concerned that disks that have not yet been inspected or reworked present a significant risk for another uncontained HPT stage 1 disk rupture. Historically, establishing an inspection or rework schedule would require using a factor of two or three below the time to failure. However, in this case, it is unknown when the cracks initiated or how many cycles elapsed from crack initiation to failure. Therefore, to establish a conservative margin for these disks, inspection and rework should occur well before the 5,144 CSN thresholds where fatigue cracks were found or the 7,547 CSN thresholds where the US Airways disk failed.

Because the Safety Board is concerned that another failure may be imminent if immediate action is not taken, on August 28, 2006, the Safety Board issued one urgent and five other recommendations to the FAA. These recommendations focused on lowering the inspections requirement to 3,000 CSN and to review the stress analysis of the disks.

Helicopters

Servo Actuators

On August 10, 2005, a Sikorsky S-76C+ helicopter, operated by Copterline under Finland registration, departed Tallinn, Estonia, for Helsinki, Finland. The helicopter experienced an upset and crashed into the Baltic Sea, killing all 12 passengers and two pilots. The FDR showed that the helicopter suddenly pitched up and rolled to the left, followed by a series of rotations to the right until striking the water. The Safety Board is assisting the Aircraft Accident Investigation Commission (AAIC) of Estonia in the investigating the accident under the provisions of Annex 13 to the International Convention on Civil Aviation.

This accident was unique in that it was the first time the Safety Board had examined FDR information from a helicopter accident. FDR data and aerodynamic simulations are consistent with an uncommanded extension of the forward actuator that would result in a large nose-up pitch upset, a large roll to the left, an aft movement of the cyclic control, and an upward movement of the collective control.

During postaccident testing, the accident helicopter's forward actuator failed a manufacturer's acceptance test. The actuator would extend on command, but the retraction time to the neutral position was much slower than the test protocol specified. Subsequent disassembly of the actuator revealed several discrepancies including: large pieces of coating material had flaked; the piston head and balance tube seals had excessive wear and pieces of the coating were embedded in the seals and control valve, all of which contributed to internal hydraulic fluid leakage; pieces of the coating had blocked one of the return ports in the control valve; and numerous pieces of coating were found throughout the actuator.

Because proper operation of main rotor actuators is critical to safe flight, on November 17, 2005, the Safety Board urged the FAA to take immediate action to ensure the continuing airworthiness of the S-76 fleet.

On April 21, 2006, the FAA issued an NPRM for the detection of high leakage rate servo actuators and the reduction of the time-in-service interval for overhauling the servo actuators. Additionally, the Safety Board's recommendation letter resulted in many operators conducting leakage tests of their servos without a regulatory requirement. To date, the FAA has not mandated corrective action.

Terrain Awareness

The prompt safety actions taken as a result of the Estonia investigation were, to a large extent, due to the availability of the FDR data; however, the investigation of another S-76 accident was hampered by the lack of recorded data. On March 23, 2004, an Era Aviation Sikorsky S-76A++ helicopter crashed into the Gulf of Mexico about 70 nautical miles south-southeast of Galveston, Texas. The captain, copilot, and eight passengers aboard the helicopter were killed, and the helicopter was destroyed by impact forces. The Safety Board determined that the probable cause of this accident was the flight crew's failure to identify and arrest the helicopter's descent for undetermined reasons, which resulted in controlled flight into terrain (CFIT).

Although the investigation was hampered by the fact that there was no recorded flight data information, the Safety Board concluded that if TAWS had been installed aboard the accident helicopter, the system's aural and visual warnings should have provided the flight crew with ample time to recognize that the helicopter was descending toward the water, initiate the necessary corrective actions, and recover from the descent. Therefore, the Safety Board recommended that the FAA require all existing and new U.S.-registered turbine-powered rotorcraft certificated for six or more passenger seats to be equipped with a TAWS.

Automatic Dependent Surveillance-Broadcast (ADS-B)

The Era Aviation investigation also found that the FAA cannot provide flight-tracking services for low-flying aircraft in the Gulf of Mexico beyond the capabilities of existing FAA land-based radar sites.

The FAA's Safe Flight 21 Gulf of Mexico initiative was developed to determine whether automatic dependent surveillance-broadcast (ADS-B) technology would be effective in providing pilots with navigation, air traffic, terrain, and weather information in the cockpit and enabling air traffic controllers and operators to provide surveillance (including position and altitude) of low-flying aircraft in those areas with limited or no radar coverage.

ADS-B technology has already been successfully deployed in Alaska as part of the Safe Flight 21 Capstone program. The FAA's Capstone website indicates that, according to a 2004 safety study by the University of Alaska, the accident rate for aircraft under the Capstone program had decreased by 47 percent from 2000 to 2004. Also, according to a 2003 safety study contracted by the Capstone program, the ADS-B technology used in the Capstone program would have been effective in preventing about 80 percent of the en route CFIT accidents that occurred in southwest Alaska (the Phase I Capstone area) between 1990 and 1999.

ADS-B technology has many potential benefits for flight operations in the Gulf of Mexico. For example, if the ADS-B infrastructure had been operational in the Gulf of Mexico at the time of the accident, (1) the Era Aviation dispatcher would have had better flight-tracking and communication capabilities and thus could have monitored the accident helicopter's flightpath and provided an alert to the flight crew about the descent, and (2) the pilots would have received a warning in the cockpit about the descent. Also, ADS-B technology has many potential benefits for search and rescue operations in the Gulf of Mexico. For example, in September 2005, a Houston Helicopters S-76A helicopter was ditched in the Gulf of Mexico after an in-flight fire. The 2 pilots and 10 passengers escaped from the helicopter but remained in the water for about 7 hours until they were located by U.S. Coast Guard personnel using night vision goggles. ADS-B technology would have facilitated the search and expedited the rescue of the helicopter occupants. In addition, ADS-B technology would benefit accident investigations because information on an aircraft's airspeed, altitude, and position (that is, whether the aircraft was turning, climbing, or descending) would be available to investigators.

On March 1, 2006, the FAA informed the Safety Board verbally that the Gulf of Mexico would be among those areas in the first segment of ADS-B infrastructure deployment.

It would be an enormous contribution to flight safety if the milestones for the National ADS-B Program in the Gulf of Mexico are achieved or ahead of schedule and that the fiscal year 2010 completion date for ADS-B deployment in the Gulf of Mexico does not slip. This matter is especially important given the number of passengers and flights in the region (in 2004, more than 2.3 million passengers were transported aboard 1.3 million flights) and the inherent risks of offshore helicopter operations.

Boeing 777 Latent Software Deficiency

On August 1, 2005, a Malaysian Airlines 777-200 aircraft, being operated on scheduled passenger service from Perth, Australia, to Kuala Lumpur, Malaysia, experienced a severe uncontrollable pitch-up event while passing through approximately 36,000 feet with the autopilot engaged. The pitch-up continued, causing the airplane's speed to decrease to the point where the airplane's stickshaker activated, signalling approach into airplane stall conditions. The flight crew recovered the airplane to normal controlled flight at approximately 38,000 feet and returned to Perth for an uneventful landing. The Safety Board is participating in the investigation led by the Australian Transport Safety Bureau (ATSB) in accordance with Annex 13 to the Convention on International Civil Aviation.

Safety Board investigators conducted examinations and testing of the hardware and software components of the Fault Tolerant Air Data and Inertial Reference Unit (F-T ADIRU) box at the manufacturer's facility with technical assistance provided by the Boeing Company and the box manufacturer, Honeywell. This testing and examination revealed that multiple accelerometer sensor outputs had failed inside the unit and that the onset of the pitch-up event coincided almost exactly with the failure of the second accelerometer device output. This occurrence in the presence of other operating conditions could have been catastrophic. As a result and in response to the Safety Board's investigation, the FAA directed interim safety action

be taken to immediately install a version of the software that was not subject to the deficiency until such time as a revised, permanent software fix could be installed.

Both Honeywell and the Boeing Company performed extensive internal process audits to validate the Air Data Inertial Reference System and F-T ADIRU designs and review all of the safety issues raised by both the ATSB and the Safety Board as a result of the investigation. Five hundred thirty 777 aircraft have been delivered to 34 operators worldwide since 1995. Up until the time of this incident, the 777 fleet had accumulated in excess of 10 million flight hours without a related event.

This investigation represented a textbook case in which cooperation between two investigation authorities, the ATSB and the Safety Board, working with the FAA and industry, were able to determine the cause of a serious upset event and rapidly implement corrective actions before there was an accident.

Air Cargo Accident Investigations

On February 7, 2006, a Douglas DC-8, operated by United Parcel Service Company (UPS) as flight 1307, landed at Philadelphia International Airport (PHL), Philadelphia, Pennsylvania, after the crew reported a cargo smoke indication. Ground personnel reported flames shooting through the crown of the airplane after it touched down. The three flight crewmembers were able to evacuate with minor injuries; however, the aircraft was essentially destroyed.

The Safety Board held a public hearing on this accident July 12-13, 2006. Issues addressed at the hearing included: airport rescue and firefighting response; design, testing, and failure modes of lithium batteries; regulations concerning the shipment of lithium batteries on aircraft; and airplane fire suppression systems.

Previously, the Safety Board held a public forum on air cargo safety from March 23 to 24, 2004. The forum was attended by over 160 participants representing industry associations such as the FAA, Cargo Airlines Association, Airline Pilots Association, National Air Carrier Association and the Regional Airline Association, as well as major cargo carriers like Federal Express and Hawaiian Airlines. Panel discussions addressed operational, human factors, and regulatory issues associated with cargo operations.

Other recent Safety Board investigations involving cargo aircraft include the December 2003, hard landing accident involving a Federal Express MD-10 in Memphis, Tennessee, and the July 2002, accident involving a Federal Express Boeing 727 that landed short in Tallahassee, Florida. Both of these accidents resulted in hull losses.

Unmanned Aerial Vehicles/Systems (UAV/S)

On April 25, 2006, the Safety Board launched a regional team to the Nogales, Arizona, crash site of a General Atomics Predator B unmanned aerial vehicle.

The aircraft crashed near a house in a lightly populated residential community. There were no injuries and the aircraft was substantially damaged. Equipment failures and operational failures led to the loss of command control of the airplane, engine stoppage, and a gliding descent to a crash landing. The accident, which is still under investigation, will include review of areas such as training, mission planning, systems/software reliability, design of operator consoles, system operation, and management of the UAV.

This was the Safety Board's first launch to a UAV accident. This was a public-use aircraft operating in the national airspace by the Department of Homeland Security, U.S. Customs and Border Protection agency. We expect to be investigating more UAV accidents as the numbers of operations increase in the United States.

Flight Recorders

Since January 2000, the Safety Board has investigated numerous accidents involving turbine-powered aircraft not required to operate with either a CVR or an FDR. Included among these accidents was the October 25, 2002, accident involving a Raytheon (Beech) King Air that crashed on approach to Eveleth-Virginia Municipal Airport, Eveleth, Minnesota, killing all eight persons on board, including Senator Paul Wellstone. The airplane was not equipped with either a CVR or an FDR at the time of the accident, nor did Federal regulations require it to be so equipped.

The Safety Board has investigated several cases in which the aircraft was not required to be equipped with a flight recorder, but a CVR was installed voluntarily on the aircraft. The Board has found that data from these CVRs provided invaluable information during its investigations. Specifically, in the beginning phases of an investigation, CVR data may reveal operational issues that are not readily apparent from the physical evidence found at an accident site, enabling the Safety Board to immediately narrow the focus of its investigation and issue safety recommendations quickly to prevent similar accidents. In some instances, CVR data may be the sole source of evidence for a probable cause.

In addition, Safety Board investigators have repeatedly found that CVRs installed in conjunction with FDRs provide data instrumental in reconstructing events leading to the accidents. Specifically, CVRs have provided insight into the operational environment within the cockpit and FDRs have provided information regarding the aircraft's performance. Using data from both recorders, investigators have been able to determine the aircraft's motion and crewmember response to it, or conversely, how crewmember actions affected the airplane's performance. The CVR and the FDR each provide a different but complementary perspective on the events leading to an accident.

Although CVRs and FDRs are required on most larger passenger-carrying aircraft, the Safety Board is concerned because two categories of smaller aircraft that have experienced numerous accidents are excluded by the current regulations and are not required to be equipped with any crash-protected recorder: single-pilot certificated turbine-powered aircraft and dual-certificated cargo/passenger aircraft. As discussed earlier, the CVRs and FDRs installed on the Cessna 208B involved in the Russian icing accident and the S-76 helicopter involved in the

Tallinn, Estonia accident provided remarkable insight into the causes of those accidents, revealing safety issues that may not have been recognized without those recorders. When neither CVR nor FDR data are available, Safety Board investigators can sometimes compensate in part with radar data or air traffic control recordings. However, these data do not provide the same level of detail about the aircraft's flight path, flight conditions, or operations as that provided by CVR and FDR data. Furthermore, when accidents occur in areas outside radar coverage, these data are not available.

Considering the number of accidents occurring in these smaller aircraft, the Safety Board has identified the need to install crash-protected recording devices on all turbine-powered aircraft. The Board recognizes the economic impact of requiring both a CVR and an FDR on smaller aircraft and consequently proposes that all smaller turbine-powered aircraft be equipped with a single crash-protected recorder, the video image recorder. Such recorders obtain not only audio information like that from CVRs and event data like that from FDRs, but also information about the environment outside the cockpit window.

An image recording system, estimated to cost less than \$8,000 installed, typically consists of a camera and microphone located in the cockpit to continuously record cockpit instrumentation, the outside viewing area, engine sounds, radio communications, and ambient cockpit noises. Like the data on conventional FDRs or CVRs, image recorder data can be stored in a crash-protected unit to ensure survivability.

Air Tours

In 1995, the Safety Board issued a special investigation report on air tour accidents. Despite the numerous recommendations made in this report, the number of air tour accidents has not decreased. From January 1, 1996 to December 31, 2005, 148 air tour accidents occurred, involving 113 fatalities. In response to a recent spike of air tour accidents in Hawaii, the Grand Canyon, and other areas of the country, Safety Board staff initiated a Safety Assessment Team to study air tour safety issues. The team's task has been to research all of the recent air tour accidents, fatal and nonfatal and fixed and rotary-wing aircraft, to identify common factors in these accidents, to identify areas of safety deficiencies, and to propose recommendations to prevent future accidents.

The team has interviewed FAA inspectors and air tour operators and is evaluating the effectiveness of Special Federal Air Regulations 71 in Hawaii and 50-2 in the Grand Canyon. The majority of the team's work is complete, and several issues have been identified for additional scrutiny. These issues include FAA oversight of air tour operators in Hawaii and the Grand Canyon, specialized air tour pilot training, reporting of air tour activity data, efficacy of current air tour rules, adequacy of Part 91 air tour flights, the use of ADS-B, and actions that air tour operators can take to enhance the safety of their own operations.

The Safety Board has been informed that the FAA plans to issue a comprehensive final rule concerning air tours this fall. Although the Board has not seen the details of the final rule, it appears to address many concerns previously addressed in recommendations; however, some issues may remain. We are awaiting the final rule to see if there are additional areas in need of

attention based on some of the recent air tour accidents staff has investigated. Based on discussions with FAA staff, we are concerned that the FAA may not require operators to submit data on the number of flights or passengers carried and continue to allow the 25 nm exemption allowing commercial air tour companies to operate under Part 91.

Summary

The above cases illustrate the scope of the investigations conducted and issues addressed in recent years by the Safety Board's Office of Aviation Safety. I have also identified some of the open recommendation areas that remain of great concern to the Safety Board and that directly relate to the safety of the traveling public. The addition of very light jets, UAVs, privately launched space vehicles, and light sport aircraft may present new and potentially significant challenges to the aviation safety community. As I previously mentioned, the United States enjoys a very safe air transportation system and the Safety Board and its staff are dedicated to continuing to find ways to make aviation travel even safer.

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Mr. Chairman, this completes my statement, and I will be happy to respond to any questions you may have.